Introduction

Time and horizon slices through volumetric dip can delineate faults, folds, channel edges, karst collapse, and many other geologic features of interpretation interest. While less commonly used in interpretation presentations than coherence, amplitude, impedance, and even curvature attributes, accurate estimates of volumetric dip are critical to the accurate calculation of all geometric attributes and structure-oriented filtering and is a key component in the emerging seismic geochronology analysis software. Multiple software platforms provide different volumetric dip calculations, with one vendor providing no less than five different algorithms. While not exhaustive, in this case study we apply six of the more common volumetric dip computations to estimate volumetric dip using an offshore New Zealand 3D seismic survey.

Method 2: Event Dip

The event dip calculates the derivatives of the seismic amplitude in the x, y, and z directions, forming a local 3 component vectors.

Method 4: Globally Consistent Dip Estimation

The GST is calculated by cross correlating the three derivatives with each other forming a 3x3 GST. The elements of the tensor are then smoothed individually by a low-pass filter. The eigen vector with the largest eigenvalue of the GST matrix is the normal to the plane that best fits the data variability.

Method 5: Dip Steering

This method consists of three dip steering cubics (raw, detailed, and background) and is calculated using either the BJG Fast Algorithm or the Fast Fourier Transform (FFT). The concept of dip steering is that attributes are guided according to a surface of constant phase (Figure 13) and are calculated from the seismic amplitude data in line and cross line directions of the extremum (Figure 14).

Method 6: Plane Wave Destructor (PWD)

Fomel (2002) created this method as an initial model for migration. This method builds a three-dimensional filter/operator (destructor) that runs along the seismic volume calculating the dip. Figure 19 shows the output using the PWD.

Conclusions

A comparison of the different algorithmic methods used to estimate volumetric dip Chart 3.